

Tamias canipes. By Troy L. Best, Jarel L. Bartig, and Stephanie L. Burt

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Tamias canipes (Bailey, 1902)

Gray-footed Chipmunk

Eutamias cinereicollis canipes Bailey, 1902:117. Type locality "head of Dog Canyon (Howell, 1929:101), Guadalupe Mts., Texas. Altitude 7,000 feet in Transition Zone."

T[amias]. canipes: Levenson et al., 1985:242. First use of current name combination.

CONTEXT AND CONTENT. Order Rodentia, Suborder Sciuromorpha, Family Sciuridae. The genus *Tamias* contains about 24 species (Honacki et al., 1982; Patterson, 1984a); *T. canipes* is in the subgenus *Neotamias* (Levenson et al., 1985). Two subspecies of *T. canipes* are recognized (Hall, 1981):

T. c. canipes (Bailey, 1902:117), see above.

T. c. sacramentoensis (Fleharty, 1960:240). Type locality "Sacramento Mountains, 1 mi. S Cloudcroft, altitude 9000 ft., Otero Co., New Mexico."

DIAGNOSIS. *Tamias canipes* (Fig. 1) is distinguished from other chipmunks by the gray dorsal surfaces of the hind feet (Findley et al., 1975). In southern New Mexico, *T. quadrivittatus*, *T. cinereicollis*, and *T. canipes* were considered conspecific until bacular and karyotypic differences were demonstrated (Fleharty, 1960; Patterson, 1980b, 1984b).

Compared with *T. minimus*, *T. canipes* is larger, has a whitish upper lip, and has brownish lateral stripes (Findley et al., 1975). Compared with *T. cinereicollis*, the skull of *T. canipes* (Fig. 2) averages slightly larger (Howell, 1929). *T. canipes* does not possess solid black in the lateral dorsal stripes. These are mixed blackish and rusty in *T. canipes*, and the centers are solid black in *T. cinereicollis* (Stone and Rehn, 1903). In *T. canipes*, the outer pair of dorsal stripes is more brownish and the sides of the nose and face are less heavily washed with buff. Feet are more grayish, tail edgings paler and more grayish, and hind foot averages shorter (Howell, 1929). In fresh postbreeding pelage, *T. canipes* is grayer throughout, with paler and duller ochraceous on the sides. Tips of long hairs on the rump and upper surface of tail are white instead of yellowish. The feet are clear gray without a tinge of yellowish. The black dorsal stripe reaches forward to between the ears (Bailey, 1902).

The skull of *T. canipes* averages larger, and has a relatively longer and more slender rostrum than that of *T. quadrivittatus*.



FIG. 1. A male *Tamias canipes* from Hoecradle Canyon, Jicarilla Mountains, Lincoln Co., New Mexico. Photography by T. L. Best and T. D. Henry.

The shoulders have a grayish wash (the same region is tawny in *T. quadrivittatus*). The ocular stripe is broader and more blackish and the head is darker and more grayish. The dark dorsal stripes average broader, the outer pairs are more brownish, and the feet are more grayish (Howell, 1929). Karyotypically, *T. quadrivittatus* has a "B" karyotype, while *T. canipes* has an "A" karyotype (Patterson, 1980b).

The baculum of *T. quadrivittatus* generally is longer and less robust than *T. canipes* (Patterson, 1980b, 1982). When length of baculum is plotted against greatest length of skull, *T. canipes* is separated from *T. quadrivittatus* to a lesser extent than it is from *T. cinereicollis* (Patterson and Thaler, 1982). Compared with *T. cinereicollis*, the length of shaft of the baculum is 3.10-3.49 mm (4.7 in *T. cinereicollis*) and the angle formed by the shaft and tip of baculum is 112-120° (133-137° in *T. cinereicollis*-Hall, 1981; Patterson, 1980b).



FIG. 2. Dorsal, ventral, and lateral views of cranium, and lateral view of mandible of *Tamias canipes* from Capitan Mountains, 9,500 feet, Lincoln Co., New Mexico (male, University of New Mexico Museum of Southwestern Biology 4749). Greatest length of cranium is 35.5 mm. Photographs by T. H. Henry.

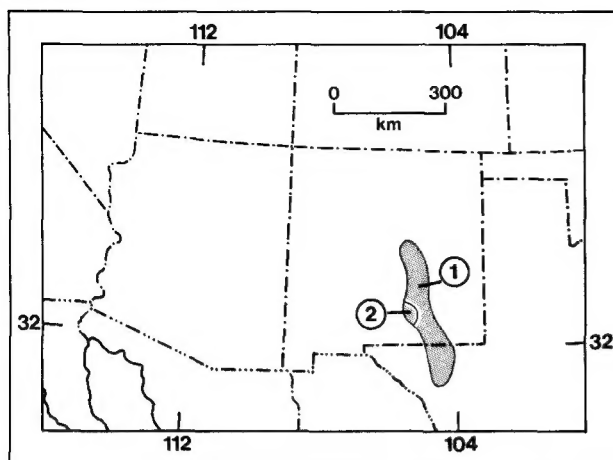


FIG. 3. Distribution of *Tamias canipes* in western North America (Hall, 1981): 1, *T. c. canipes*; 2, *T. c. sacramentoensis*.

GENERAL CHARACTERS. *Tamias canipes* is a small, grayish-appearing squirrel, the upperparts marked with four whitish and five brownish stripes. The nape and shoulders usually have a wash of smoke gray. The dorsal stripes are black or brownish black. The inner pair of pale stripes is smoke gray, and the outer pair is grayish white (Davis, 1974).

In summer pelage (August–September), the top of the head is mixed sayal brown and grayish white, bordered on each side with a stripe of fuscous black, shaded with sayal brown. The ocular stripe is black and is edged with sayal brown. The submalar stripe is sayal brown and shaded with fuscous. The ears are chaetura drab, broadly margined posteriorly with grayish white and washed on the anterior margin with sayal brown. Postauricular patches are pale smoke-gray. Shoulders, rump, and thighs have a wash of smoke gray, sprinkled with pinkish buff. The median dorsal stripe is broad, black, and bordered with sayal brown. The outer pair of dark stripes is fuscous black sprinkled with mikado brown or sayal brown. Lateral stripes are distinct and mikado brown. Sides are sayal brown or pale clay in color. The median pair of pale stripes is grayish white or pale smoke-gray. The outer pair of stripes is white. The tail above is fuscous black (the bases of hairs are pinkish cinnamon) overlaid with pinkish buff, tilleul buff, or pale smoke-gray. Hind feet are smoke-gray, faintly shadowed with pinkish buff. The tail beneath is ochraceous tawny, bordered with fuscous black and edged with pinkish buff, tilleul buff, or pale smoke gray. The underparts are creamy white. Winter pelage (May) is similar to summer pelage, but averages slightly more grayish above and paler on the sides (color nomenclature follows Ridgeway, 1912—Howell, 1929).

The population of gray-footed chipmunks on a lava field in southcentral New Mexico is darker in coloration than the population on the nearby Sacramento Mountains. This lava-dwelling population has more black hairs mixed in with dark and buffy ones on the dorsal stripes, and the buffy tones are less bright. The total difference in color is not great (Benson, 1933).

Average and range of measurements (in mm) of *T. c. sacramentoensis* from the Sacramento Mountains, New Mexico, are: total length, 245 (227–264); length of tail, 102 (91–108); length of hind foot, 34.6 (34.0–36.0—Flehart, 1960). Average and range of measurements (in mm) of adults from Guadalupe Mountains, Texas, and White Mountains, New Mexico, are: total length, 228.1 (210–250); length of tail, 99.9 (92–115); length of hind foot, 33.5 (32–35); length of ear, 15.2 (14–17); greatest length of skull, 36.9 (36.1–38.4); zygomatic breadth, 19.8 (19.3–21.0); cranial breadth, 15.5 (14.7–17.1); interorbital breadth, 8.2 (7.9–8.6); length of nasals, 12.1 (11.7–12.3—Howell, 1929). Means (in mm) of additional characters are: mandibular length, 20.7; length of molar toothrow, 5.7; nasal width, 3.6; diagonal length of orbit, 9.5; premaxilla length, 11.9; depth of cranium, 14.6; mass, 70.4 g (Patterson, 1980b).

Males are smaller than females (Levenson, 1990). *T. c. sacramentoensis* is strongly dimorphic while *T. c. canipes* is not. Males of the two subspecies are nearly identical (Callahan, 1976). There is considerable geographic variation. For example, gray-footed chipmunks from the Sacramento Mountains are much larger and darker

in color than those from the Guadalupe, Capitan, and Gallinas mountains (Flehart, 1960).

DISTRIBUTION. *Tamias canipes* occurs in the Gallinas (Patterson, 1981), Sacramento (Patterson, 1980a), Jicarilla, Capitan, White, and Guadalupe mountains of southeastern New Mexico and western Texas (Fig. 3—Howell, 1929). In Texas, it occurs only in the Sierra Diablo and Guadalupe mountains in the Trans-Pecos region (Davis, 1974). Its distribution is centered in the Sacramento Mountains, New Mexico, which is the most likely southern range for interglacial persistence of montane populations. This region supports an extensive area of high-elevation habitats (Patterson, 1984a). Within the range of this species, it occurs throughout the full width of the Transition and Canadian zones, but is more abundant in spruce and fir forests (*Picea*, *Abies*, *Pseudotsuga*) of the Canadian zone. Elevational range is from ca. 1,600 (Davis, 1940) to 3,600 m (Bailey, 1931).

FOSSIL RECORD. The genus *Tamias* evolved by the early Miocene (Black, 1972). A fossil of *T. canipes* was reported from Pratt Cave, Guadalupe Mountains, Culberson County, Texas (Lundelius, 1979). Specimens from late Pleistocene deposits in Fowlkes Cave, Culberson County, Texas, probably are of this species. Species that may have occurred here at the same time as *T. canipes* include *Sorex monticolus*, *S. palustris*, *Myotis lucifugus*, *M. velifer*, *Sylvilagus floridanus*, *Marmota flaviventris*, *Peromyscus maniculatus*, *Erethizon dorsatum*, *Felis rufus* (Dalquest and Stangl, 1984), and *Microtus longicaudus* (Harris, 1985).

Although once considered as conspecifics (Bailey, 1902), there is no basis for the derivation of *T. canipes* from *T. cinereicollis*. Instead, both species appear to have been derived independently from a northern stock currently represented by *T. quadrivittatus*. The early synonymy of *T. canipes* and *T. cinereicollis* thus reflects convergent evolution of these southern populations (Patterson, 1982).

FORM AND FUNCTION. Summer molt takes place in June and July, occurring earlier in males than in females. In August, they are in fresh pelage (Davis, 1940). On 31 May, a male from Guadalupe Mountains, Texas, was molting in a large band across the dorsum about halfway between head and rump. Two other males observed 31 May and 9 June were molting in only small areas. On 3 June, a female was molting on the chest, and on 6 August a female was molting in two small areas on the rump (Genoways et al., 1979). An adult male from Mount Capitan, New Mexico, was in worn winter pelage on 15 June, with new summer pelage just beginning to appear in patches on the back (Howell, 1929).

The metaconid on m1 is strongly joined to the anterior cingulum, which is well defined and straight. The protoconid and hypoconid are well separated, and a well-developed mesoconid is located between them (Lundelius, 1979).

The baculum of *T. canipes* is short and stocky (Fig. 4). Means of bacular measurements (in mm) from the Guadalupe, White, Capitan, and Gallinas mountains, respectively, are: total length, 3.78, 4.00, 4.01, 4.12; length of tip, 1.61, 1.69, 1.66, 1.60; height of keel, 0.69, 0.68, 0.69, 0.66; bend of shaft, 0.82, 0.89, 0.88, 0.80; width of base, 0.82, 0.94, 0.89, 0.93; width of neck, 0.31, 0.38, 0.34, 0.31; width of tip, 0.51, 0.55, 0.54, 0.57; angle of tip (in degrees), 118.25, 119.87, 120.25, 121.00 (Patterson, 1980b). Range of bacular measurements (in mm) for specimens from the Gallinas, Capitan, Sacramento, and Guadalupe mountains are: length of shaft, 2.97–3.40; greatest width of base, 0.84–1.00; angle formed by shaft and tip, 112.0–121.5° (Flehart, 1960).

The baculum of *T. c. sacramentoensis* has a short shaft, wide base, and angle <121°. Average and range of measurements (in mm) of 10 bacula are: length of shaft, 3.23 (3.10–3.49); greatest width of base, 0.91 (0.78–1.00); angle formed by shaft and tip, 117° (112–121°—Flehart, 1960).

A female genital bone (baubellum or os clitoris) is present. Measurements for *T. canipes* apparently were lumped with those of *T. cinereicollis* in a study of interspecific variation of this bone in the genus *Tamias* (Sutton, 1982).

ONTOGENY AND REPRODUCTION. One litter is produced each year. At Cloudcroft, New Mexico, only adults were found from 28 May to 2 June; young evidently were still in their dens (Bailey, 1931). In the Guadalupe Mountains, Texas, a female contained four embryos that were 28 mm in crown-rump length on 6 August (Genoways et al., 1979). Apparently, young are born from mid-May through August (Bailey, 1931). Two females from the

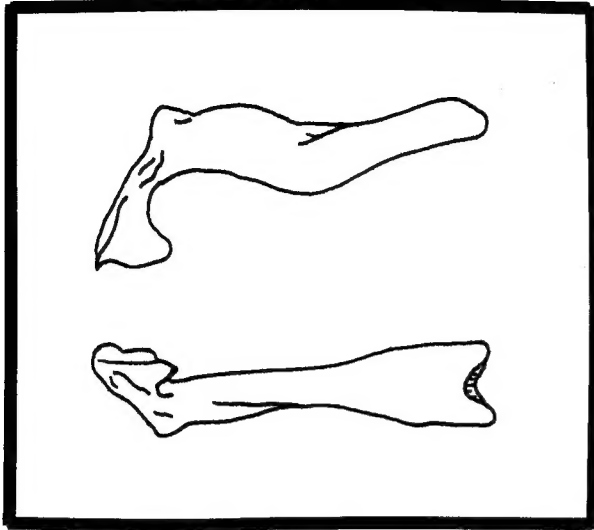


FIG. 4. The baculum of *Tamias canipes sacramentoensis*. The upper drawing is a lateral view and the lower drawing is a dorsal view (modified from Fleharty, 1960).

Guadalupe Mountains, Texas, showed no gross reproductive activity on 3 and 9 June. Three males had the following length of testes: 18 mm on 31 May; 17 mm on 31 May; 5 mm on 9 June (Genoways et al., 1979).

Adult size is reached by late summer and early autumn (Bailey, 1931; Davis, 1974). Thus, there is little time for young to develop and gather winter stores of food before cold weather (Bailey, 1931).

Gray-footed chipmunks may be separated into three age classes on the basis of condition of M3. Animals may be considered as adults if the molar is so worn that dentine can be seen, as subadults if the molar is fully erupted and dentine is not visible, and as juveniles if the molar is not fully erupted (Fleharty, 1960).

ECOLOGY. *Tamias canipes* primarily is a forest-dwelling chipmunk (Davis, 1974; Lomolino et al., 1989). In favorable situations it descends to lower zones, such as the lava field near Carrizozo, in southcentral New Mexico (Findley et al., 1975). Its favorite haunts are downed logs at the edge of clearings (Fig. 5). It also occurs in dense stands of mixed timber (*Quercus*, *Pinus*, *Abies*) and on brushy hillsides, particularly where crevices in rocks offer retreats (Davis, 1974). Based upon observations from 18 localities, *T. canipes* occurred in the following habitats: desertscrub, 0%; grassland-chaparral, 6%; woodland, 17%; mixed conifer, 72%; spruce-fir, 6%; alpine tundra, 0% (Lomolino et al., 1989).

Except for *Peromyscus*, this species is the most common mammal in the Guadalupe Mountains, Texas (Davis and Robertson, 1944). However, in parts of its range it is uncommon, such as in the lava association in southcentral New Mexico (Blair, 1943). Possibly because of its infrequent occurrence in some areas, it has been listed as rare or endangered (Findley and Caire, 1977).

In southcentral New Mexico, *T. canipes* occurs in a variety of habitats. It ranges upward from pinyon-juniper (*Pinus-Juniperus*) to spruce-fir (*Picea-Abies*) communities. It is most numerous in yellow pine (*Pinus ponderosa*) and Douglas fir (*Pseudotsuga menziesii*) communities (Dice, 1930). Lava habitat occupied by gray-footed chipmunks in this area is characterized by snakeweed (*Gutierrezia*), woolly groundsel (*Senecio longilobus*), purple dahlia (*Parosela formosa*), cholla cactus (*Opuntia*), yucca (*Yucca*), streptanthus (*Streptanthus valida*), saltbush (*Atriplex canescens*), rattail cactus (*Opuntia leptocaulis*), sumac (*Rhus microphylla*), red salvia (*Salvia henryi*), bitterweed (*Actinea mearnsii*), borage (*Cryptanthus crassiseptala*), erigeron (*Erigeron*), Apache plume (*Fallugia paradoxa*), blue curls (*Phacelia caerulea*), clammy weed (*Polanisia*), bladderpod (*Lesquerella*), tansy mustard (*Sophia halictorum*), verbena (*Verbena*), juniper (*Juniperus monosperma*), and unidentified grass (Blair, 1943).

The Guadalupe Mountains are in a semi-arid, mesothermal environment with potential evapotranspiration from 71 to 57 cm (Blair, 1950). In these mountains, *T. canipes* inhabits coniferous forests (Davis and Robertson, 1944; Findley et al., 1975). It also



FIG. 5. Habitat occupied by *Tamias canipes* in the Jicarilla Mountains, Lincoln Co., New Mexico. Photograph by T. L. Best.

is found in small numbers below 2,100 m, where it often is associated with rocky outcroppings (Davis, 1940). Prominent vegetation in the coniferous habitat includes yellow pine, limber pine (*P. flexilis*), Douglas fir, barberry (*Berberis haematocarpa*), chinquapin oak (*Quercus muhlenbergii*), and buckthorn (*Rhamnus purshiana*—Davis and Robertson, 1944). In September, this species is more closely associated with shrubby oaks (*Quercus*—Bailey, 1905).

Nests often are constructed in cavities of downed timber. One nest was underground among roots of a decaying stump (Davis, 1940). Arboreal tree nests have not been reported for *T. canipes* (Broadbooks, 1977).

Apparently, gray-footed chipmunks feed to some extent on seeds of small cones of spruces and firs, but it is not always possible to be sure what animal is responsible for scattered cone scales over rocks and logs where they feed. Acorns seem to form their principal food supply during late summer and autumn. These are gathered and stored from the time they begin to ripen until they are all gone or buried by snow. Scattered acorn shells are the most common mark of feeding grounds, and cheekpouches often contain one large or several small acorns. Wild sunflower and many small seeds are gathered, eaten, or stored. Gooseberries, currants, and other berries are eaten, and fields of wheat, oats, and barley attract chipmunks to their vicinity. Along Peñasco Creek, this species may carry grain away from margins of fields. As little of their range, however, is in cultivated areas, depredations of this nature are not likely to be serious (Bailey, 1931).

Food consists of a variety of items such as acorns (*Quercus*), seeds of Douglas fir, currants, gooseberries (*Ribes*), mushrooms, green vegetation, and insects (Davis, 1974; Van Dersal, 1938). On a lava field in southcentral New Mexico, cheekpouches of a specimen were full of juniper berries (*Juniperus*—Benson, 1933).

No congeners occur sympatrically with *T. canipes* (Patterson 1981). However, *T. minimus* occurs high on Sierra Blanca and in James Canyon on the east side of the Sacramento Mountains. In both of these places, *T. minimus* is rare (Findley, 1987). In the absence of *T. dorsalis*, *T. canipes* occurs down to the lower edge

of the woodland, and in places even into the grassland (Findley, 1969).

Associated mammals include *Chaetodipus intermedius*, *Peromyscus eremicus*, *P. leucopus*, *P. nasutus*, *P. truei*, *Reithrodontomys megalotis*, *Neotoma albigula*, *N. mexicana*, *N. micropus*, *Spermophilus variegatus*, *Ammospermophilus interpres*, *Sylvilagus audubonii*, *Lepus californicus*, *Dipodomys ordii*, *D. spectabilis*, *Perognathus flavus*, *Pipistrellus hesperus*, *Antrozous pallidus*, *Felis rufus*, *Spilogale putorius* (Blair, 1943), *Eptesicus fuscus*, *Plecotus rafinesquii*, *Ursus americanus*, *Felis concolor*, *Thomomys bottae*, *Microtus mexicanus*, *Cervus elaphus* (Davis and Robertson, 1944), *Bassariscus astutus*, *Mephitis mephitis*, *Conepatus mesoleucus*, *Dipodomys merriami*, *Peromyscus boylii*, *P. pectoralis*, and *Erethizon dorsatum* (Blair, 1950).

In the Guadalupe Mountains, Texas, birds occurring in the same habitat as *T. canipes* include *Strix occidentalis*, *Otus flammeolus*, *Dryobates villosus*, *Nuttallornis borealis*, *Cyanocitta stelleri*, *Callipepla gambelii*, *Sitta pygmaea*, *Certhia americana*, *Hylocichla guttata*, *Turdus migratorius*, *Dendroica auduboni*, *Piranga ludoviciana*, *Spinus pinus*, and *Loxia curvirostra* (Davis and Robertson, 1944). Reptiles here include *Terrapene ornata*, *Eumeces gaigeae*, *E. taylori*, *E. obsoletus*, *E. multivirgatus*, *Crotaphytus collaris*, *Cophosaurus texanus*, *Urosaurus ornatus*, *Sceloporus poinsettii*, *Phrynosoma cornutum*, and *P. douglassii*. Amphibians here include *Ambystoma tigrinum*, *Rana pipiens*, *Scaphiopus couchi*, *S. hammondi*, *Bufo compactilis*, *B. cognatus*, *B. debilis*, *B. punctatus*, *B. woodhousei*, and *Hyla arenicolor* (Blair, 1950).

The coccidian parasites *Eimeria cochisensis* and *E. dorsalis* have been reported in gray-footed chipmunks from Eddy County, New Mexico (Hill and Duszynski, 1986). No other parasites are known.

BEHAVIOR. Gray-footed chipmunks are most active shortly after sunrise, at which time they do most of their feeding (Davis, 1940). They may run along fences or over logs at the edge of clearings and burns. They are found on rocky slopes, where brush and timber offer shade and cover and cliffs afford runways, perches, and safe retreats. They are skillful at climbing rocks, cliffs, trees, and bushes. In search of food, they run through tops of scrub oak chaparral (*Quercus*) and various thickets in gulches and climb trees (Bailey, 1931). They occasionally are seen in the densest timber, but more often are in open oak scrub (*Quercus*), gathering acorns in the tops of bushes, or sitting on logs or rocks eating acorns. Both logs and rocks may be covered with acorn shells (Bailey, 1905).

These chipmunks are shy (Bailey, 1905); in thick brush and forests they are more often heard than seen (Bailey, 1931). Their light "chipper" often is heard from bushes and they may utter a low "chuck-chuck-chuck" repeated slowly from a log, rock, or low branch of a tree. The call always ceases as soon as danger is suspected (Bailey, 1905).

When alarmed, gray-footed chipmunks run to the ground and enter underground burrows or disappear among rocks, logs, brush (Bailey, 1905), or crevices; occasionally they take to the trees (Davis, 1974). From this refuge, they soon reappear, carefully peer about, and return to gathering food. Their note of alarm is a shrill, rapid chipper, like that of *T. cinereicollis*, and also similar to *T. quadrivittatus*. In case of sudden alarm at close quarters, the call becomes so rapid as to blend into a shrill squeak, but ordinarily it is a rapid trill, often repeated several times in quick succession or at short intervals (Bailey, 1931).

In the Gallinas Mountains near Corona, New Mexico, gray-footed chipmunks may be common during summer, but late in October they hibernate. It is probable that they either hibernate or remain in their dens feeding on their winter stores during cold weather of winter; but gray-footed chipmunks observed in late autumn show no indication of becoming extremely fat as do other mammals that hibernate. Deep snow in winter may make it necessary for them to depend on caches of food, and probably keeps them in underground burrows (Bailey, 1931).

GENETICS. There is probably little genetic interchange between isolated populations of *T. canipes* at the present time (Genoways et al., 1979). This species has karyotype A of *Tamias* (Patterson, 1980b). The diploid karyotype contains 38 chromosomes, including three pair of large metacentric, six pair of large submetacentric, four pair of large acrocentric, one pair of small metacentric, and four pair of small acrocentric chromosomes. The X chromosome

is submetacentric and the Y is a minute acrocentric (Sutton and Nadler, 1969).

REMARKS. Along with *T. quadrivittatus*, *T. rufus*, *T. cinereicollis*, and *T. durangae*, *T. canipes* is a member of the *quadrivittatus* species group (Patterson, 1984a). Based upon phenetic analysis of morphologic characters, *T. canipes* is closest to *T. durangae*, *T. dorsalis*, *T. cinereicollis*, *T. obscurus*, and *T. bulleri* (Levenson et al., 1985). Based upon this analysis and electrophoretic data, *T. canipes* was placed into the *amoenus* species group (Levenson et al., 1985). *T. durangae* (Callahan, 1976) and *T. bulleri* may be conspecific with *T. canipes* (Callahan, 1980).

The subspecific affinity of populations north and northeast of the Sacramento Mountains, New Mexico, is not clear. Fleharty (1960) and Patterson (1980b) indicated this population differed from *T. c. canipes* and *T. c. sacramentoensis*, but did not name a new subspecies. Hall (1981) included these populations in *T. c. canipes* (Fig. 3).

Tamias is from the Greek *tamias* meaning a storer or distributor. The specific epithet *canipes* is derived from the Latin *canitia* meaning gray in color and *pes* meaning foot (Jaeger, 1955).

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